Chesapeake Bay Program Hypoxia Collaborative Meeting

Thursday, October 6 · 1:00 – 3:00pm

This meeting was recorded for internal use to assure the accuracy of meeting notes.

ACTIONS

- ✓ Add your input on site locations to the spreadsheet. If you have specific locations in mind for the Potomac and the Rappahannock, provide that as specifically as you can to the latitude/longitude level. Feel free to add places not mentioned today that you think would have value – we don't need to limit it to what was discussed today.
- ✓ Next meeting:
    - What do chosen locations mean for logistics?
    - We had mentioned having a reference location and we didn't get to talk about this yet.

MINUTES

1:00 - Introduction *(Peter Tango, USGS & Bruce Vogt, NCBO: 5 minutes)*

Participants:

Aaron Bever (Anchor QEA), Amanda Shaver (VA DEQ), Amy Goldfischer (CRC), Breck Sullivan (USGS), Bruce Vogt (NOAA), Carl Friedrichs (VIMS), Cindy Johnson (VA DEQ), Durga Ghosh (USGS), Jay Lazar (NOAA), Jeremy Testa (UMCES), Jim Gartland (VIMS), Jim Uphoff (MD DNR), Justin Shapiro (CRC), Kevin Schabow (NOAA), Lee McDonnell (EPA), Marjy Friedrichs (VIMS), Mark Trice (MD DNR), Mary Fabrizio (VIMS), Meighan Wisswell (VA DEQ), Peter Tango (USGS), Rachel Dixon (VIMS), Rebecca Murphy (UMCES), Sandra Mueller (VA DEQ), Sean Corson (NOAA), Tom Parham (MD DNR), Troy Tuckey (VIMS)

1:05 - Revisiting the Role and Charge of the Hypoxia Collaborative Team Moving Forward
(Sean Corson, NCBO & Lee McDonnell, EPA CBPO: 15 minutes)

Sean Corson laid out the key questions and the charge for the collaborative team, and the roles and responsibilities for the group.

- The concept came out of a growing need to get higher temporal and spatial measurements not only at the surface of the Bay, but down to the water column. The initial interest was in validating the model estimates that Marjy and others have put out

for years with coarse estimates of deep channel, mid Bay hypoxia in space and time, from a high frequency measurement perspective.

- Last year and this year we had a couple pilots that have been successful and demonstrated we're able to measure at the rate and locations we want. We've also learned what kind of technology is best suited to do this, we have a good understanding of maintenance for hardware and software. That's a huge accomplishment. We understand what we need not just to put these systems in place but to maintain and run them.
- Where do we go from here? Right now we've been taking measurements, but haven't necessarily been using those measurements for hypoxic volume. Our first charge is, can we measure hypoxic volume? We know that a relatively small number of monitoring arrays should be able to do a pretty adequate job of capturing hypoxic volume in the central portion or deep channel part of the Chesapeake. That seems worthwhile. However, the conversations have evolved. Now we'd like to capture shallow water dynamics; the Bay program is moving in this direction of getting a better understanding of what's happening in shallow portions of the Bay. That's a different challenge. I'm hoping this group answer what kind of sampling design would we need to capture some kind of shallow water dynamic in a way that's meaningfully connected to living resources such as striped bass?
- Then there's delisting. It's all connected with the management actions happening on land. That can be characterized by delisting and TMDL. We've discussed identifying segments where we can evaluate the progress and understand if we can delist a segment. Are these hypoxia arrays enough, or do they need to be coupled with other programs?
- The charge for the team: Start with understanding coarse hypoxic volume, then understanding shallow water, and thinking about delisting. This will involve sampling design, operational realities and practical constraints, and how long will it take to put these things in place.
- Decision tree: this group can inform the sampling design and operations and maintenance questions, and come up with suggestions on how to pursue these 3 objectives. Those recommendations would be evaluated by the core leadership to make sure the recommendations are framed in a way that Sean and Lee can evaluate. If we need to spend more money, change the way we approach in the field, or make other big changes to the program, those would come to Lee and Sean for approval.
- Our goal is to get 3-5 of these in the water next year. If this goes well, more in future. Where and how we deploy them is up to you.

Lee McDonnell added:

- We're fortunate that the Infrastructure Investment and Jobs Act (IIJA) funding came along to make this a reality.
- How do we get to the ability to assess all water quality standards in all segments?

- We have new tools such as the 4D Interpolator. We want to tie our work to living resources. Looking at shallow waters, we want to be able to tell people a story of where they interact, which is mostly in those shallow waters. Right now we have a path for at least 5 years, but we need to think about things after that. What will we be able to tell people, what questions important to the partnership will we be able to answer with this monitoring system?

1:20 - Site Selection Process for a 2023 Deployment *(Bruce Vogt, NCBO & Peter Tango, USGS: 25 minutes)*

- Overview of decision making process in identifying stations to address goals of measuring hypoxic volume and extent, segment delisting, and living resource implications.
- Quick introduction of new Collaborative members invited to provide insights related to segment delisting and living resources
- A general reminder that initial deployments in 2023 will continue to focus on demonstrated ability to deploy, maintain, and operate the profilers.
- Bruce Vogt: We need input from the group over the next week for locations on 3-5 locations that will be deployed in the spring that will meet the 3 objectives. With your input, the leadership team will look at it, synthesize it, and make recommendations to Lee and Sean for ultimate decisions. Once we get past the initial term, we're looking to build the program out. We want to set ourselves up for success. We'll look to keep this team going and continue to provide data coming from deployment locations we choose. We hope to keep this team meeting at least on a quarterly basis as an opportunity to provide feedback.
- Peter Tango: Quarterly meetings sound good.
- Cindy Johnson: VA DEQ can't access Google products so we'll need an alternative.
- Jeremy Testa: The modeling team solicited feedback from GITs to inform tributary modeling. Could we leverage that information?
- Bruce: Vogt: I agree, I've also been part of the Multiple Tributary Modeling (MTM) process. One of the criteria in the scoring process included some of the new monitoring like this. It does make sense to look at tributaries ranked highly in that process. They're picking entire tributaries; depending on the size it includes sub-tributaries. For this, we need to get very specific within a tributary. It would serve as a starting point to say these are important (they included living resources and other criteria) but we'd need to get more specific. We can reach out to Jeremy Hanson to see when the final decision will be made, and in the meantime at least look at the reference material and final list of tributaries.
- Peter: I agree. I recall it was Potomac, York, Rappahannock, James, Choptank and Patapsco. There might be a seventh.
- Bruce: The Pocomoke was on the cusp due to interest in including a Lower Eastern Shore tributary.

- Breck Sullivan: I can get that information. They're having a smaller meeting in Mid-October with the Water Quality GIT to narrow down the decision for the Management Board, who will make the final decision in November.
- Mark Trice: For that MTM, who's doing that?
- Bruce: Modeling team. The York is already under way as a pilot area. This is being headed by the WQGIT and Modeling Workgroup who will be putting out funding to do the modeling for the tributaries identified for the fine scale shallow water modeling in the tributaries.
- Mark: This is different than the past effort? They'll be using the data we collect to enhance the model? The monitoring group should be included in that in the future.

Breck shared in the chat: Link to the latest on Multiple Tributary Model presentation: https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/Update-on-Multiple-Tributary-Model-MTM-Selection-Alex-Gunnerson-CRC-10.5.22.pdf

- Marjy Friedrichs: I'm confused about how this effort is connected to the monitoring in the Bay. This effort was to understand more about what's happening in the main Bay so they designed these arrays at multiple depths. If we go into shallow water do we need the same platforms with multiple levels? What would this give us as opposed to continuous monitoring? In the York we have great observations of oxygen that I feel are underutilized. What would this give us that existing monitoring does not?
- Peter Tango: A long term challenge is to get a range of habitats and regions from the deep channel to the surface to fully assess and do the short duration criteria on. From 2009-2012 we looked at how to make use of shallow water information and what could it tell us with links to offshore. There are some things that it is informative on and some that is not. The power that we have now is to assess habitats that we have been unable to assess in Bay mainstem. Not to exclude the possibility of multiple increments in a shallower area being informative. But we've seen that our strength is in assessing big open water areas.
- Jeremy Testa: When I think about the tributaries, yes, it's meant to reproduce the shallows better, but there are plenty of tributaries with deep water deep channel with habitat we don't know about. New monitoring will help us ascertain is this passing criteria more than we would have known with our crude sampling. If that's a goal, I don't know what we have to determine what places might be the best to help us do that, outside of going to the places we do know in tributaries that are hypoxic. Are we oversampling it or undersampling it?
- Peter Tango: That question may be the difference between aligning 3-4 locations that seem logical and do the preliminary deployments. It may take more insight and worthwhile analysis. Don't know if the models are the place to help inform that or if we can go to our long-term data and insight on that as well.

- Aaron Bever: I think the models can help. Often I fall back on some of the fisheries data. Mary's group has surface and bottom DO data that they collect along with their random stratified sampling design fish tows. Those are all over the VA waters. If you're looking to get information outside of where the long term monitoring program is, then some of the data Mary's group has is very spatially distributed. It's monthly data. I'm sure there's other sets of data out there that are similar. If you want to look outside the box of the long-term water quality monitoring data I'm sure it's out there that can help us answer where to put an instrument.
- Mary Fabrizio: I agree. I'm not familiar with everything out there but from a fisheries survey perspective, it's generally the case that we have different levels of information from different jurisdictions for fisheries. For example in VA we have surface and bottom salinity, temperature and DO, but in MD they collect salinity and temperature – there is no DO from their small trawl survey. ChesMap is not monthly but I believe it's surface and bottom and also profile data we're beginning to collect in VA.
- Jim Uphoff: Our program has been monitoring a multitude of the sub-estuaries on the scale of the Severn River or St. Clements' Bay although we work in the Chester a little bit. We collect a wider array of surface, mid and bottom DO, pH, temperature, conductivity, and Secchi depth. We do trawling in the channel and seining in the shore zone to get some idea of the fish communities. If you're looking for low DO problems then stay out of the tidal fresh and the oligohaline. All the issues we primarily see are in the mesohaline which is where we work. Generally DO isn't routinely collected in fisheries survey.

Jeremy Testa commented in the chat: There is also the benthic monitoring program. MDE has these measurements in the shellfish monitoring program.

- Jim Gartland: I concur with Mary. There is mainstem data available.
- Bruce Vogt: We've started a summary spreadsheet from each of the fishery surveys and can pull that into this group.
- Jim Uphoff: We report on this every year. You can find it on our website. There's a list of all the systems we've sampled over the years and when we've sampled them.
- Bruce Vogt: While we do want to address those objectives, within the first year we want to set ourselves up for success. When we put out 3-5 next year we have to think about maintaining the logistics of maintaining and operating those profilers. It will be difficult for us to spread these out on a large spatial scale; we'll need to look at some clustering for keeping the operations and maintenance possible.

Jay Lazar gave a quick update of the stations.

- East Gooses was damaged on August 31st, West Gooses sustained damage on September 24th. Those are both out. These two incidents are emblematic of the learning process we're going through. Currently what's available is the raw info directly from that. If a sensor is not reporting or reporting incorrectly. Probably making those data less usable. We have a replicate server that will be able to have copies of all the raw

data and a separate copy that's cleaned. We remove artifacts from sensors not operating the data and missing sensors. We'll make both the raw and the cleaned up data available. There's a learning process that's going on. We definitely need redundance. Points to the need for more sensors to be able to swap into a station if something gets damaged. Fully aware of constant field presence to do this well.

- Jeremy Testa: How often were you visiting them?
- Jay Lazar: Every two weeks, although sometimes it was three weeks due to short staffing. The two fouling events were barnacles in end of May and early June. We'll increase that frequency to prevent barnacles in the future. We saw mugula in early fall, those are more present in West Gooses. Some sensors had to be removed because they were fouled to the point of not being functional. In the early and later part of the year we should be able to relax the frequency of visits, but at other times we'll need to be out there constantly. We have independent Conductivity, Temperature, Depth, Dissolved Oxygen (CTD DO) sensors that take validation casts, and we use those every time we go out there to validate the data. With the need for the replicate server, this is an on-going work. We have the server in place now and made some great strides throughout the summer. In the future you'll be able to see both the clean data and the raw data.
- Jeremy Testa: Does it make sense to have two of these in the shop on backup?
- Jay Lazar: Our plan is to hire someone full time to augment what we're doing which will aid in hitting more maintenance visits. There is a 50% redundancy built into this; if we have 3 systems out there, we'll have 2 backups. Initially we planned to have complete system backups, and that's just a database update to make sure the right controller is providing information for the right location. When we pull those up, we can swap in a new sensor. We need more sensors than we need more complete systems because the deeper water sensors have been performing very well and not getting fouled as indicative of the data on the East Gooses deeper water.
- Mary Fabrizio: Can you help me better understand what do we mean by shallow water?
- Peter Tango: In the context of criteria assessment, shallow water is two meters or less associated with SAV habitat. Six meters is general shallow water conditions. The Bay model is up to two meters but 25% of the Bay is two and under. Jay added that this is one of the values of the pilot locations selected. The West Gooses station is 8 meters, the bottom sensor is at 7 meters. That will be useful in informing what the value of a shallow water station might be.
- Rebecca Murphy: We've had a lot of continuous monitoring shallow station data which could be used a lot more. One thing I found useful about this data is what would be considered shallow water at these deep stations. The dynamics of the oxygen changing in the boundary layer of pycnocline. That's something I'm working on a lot with the 4-Dimensional Interpolator tool. As we figure out how to capture short term dynamics of not very deep water in a deep region, this may be helpful. We do have the open water designation that's pretty much everywhere that's water above the pycnocline. I don't

know where the balance lies with open water compared to true shallow water, but knowing what's going on at the top of the water column is helpful.

- Peter Tango: That missing information for water quality criteria is short duration DO. The original design of the water quality monitoring program wasn't for short duration criteria so we're playing catch up. That was part of the interest here as well as deep water and deep channel.

Marjy Friedrichs commented in the chat:
Do we expect continuous nitrate information from these arrays? Some of these sites would be great if we have that information, but not necessarily ideal if we do not yet have those sensors ready to go out.
Jeremy Testa responded in the chat:
We deployed a continuous NO3 sensor near Annapolis and in the CB4 segment in 2018. I'd be happy to share that and what we learned from it if that helps
Jay Lazar responded in the chat:
Marjy, we do not have nitrates on the sensors.

1:45 - Group Discussion and Suggestions for Site Selection *(Bruce Vogt, NCBO: 1 hour)*

- Review the locations identified for profiler placement listed in the PSC monitoring report (*Peter Tango, USGS*)

Peter's presentation can be found here.

- A Google Spreadsheet will be shared with the group to allow for real-time input on site selection. The Collaborative will aim to find locations where multiple benefits overlap

Discussion:

- Marjy Friedrichs: I would love to have continuous nitrate near USGS gauges. Those would be ideal. But if we don't have nitrate, salinity that far upstream and temp won't tell us much. To really use this technology of 4 sensors in a row we need water with this depth. I don't see the point of putting it in shallow water of 2 meters. There's lots to be learned in deep section of tributaries.
- Peter Tango: It's 18 segments that are classified as deep channel habitat.
- Jay Lazar: Is it advantageous to select a tributary that's close to meeting criteria attainment or whatever threshold is needed? I'm guessing those are based on monthly values. Can we use what we're seeing at East Gooses (deeper station) to hypothesize whether or not having continuous more frequent data would change the story. If you look at what we have in east gooses monthly, everything looks bad. Looking at it weekly, you see improvement because you get daily variability. If we're trying to test if we can meet the thresholds and delist a segment where would you start?
- Peter Tango: We're basing that 30 day mean condition on one or two data points a month. Using high frequency information to evaluate across criteria is a new frontier. What we have are estimates of the conditions, and any of the segments will provide us

with a test case of being able to do a full assessment. The added value of the Potomac, from the uncertainty, fisheries, and modeling side, are cross interest benefits for the lower Rappahannock and lower Potomac. We're just starting to look at lower tributary connection with the interpolator.

- Amanda Shaver: Are the two proposed in the tributary for covering redundancy and will go in deepest part or nearshore (for Rappahanock and Potomac)?
- Peter Tango: Offshore and leave shallow water to shallower water instruments. Amanda asked why two? Peter said up for discussion. Two sites would give a sense of spatial variability of conditions throughout the segment. Tish Robertson compared 30 day mean inshore and offshore site off the Potomac. The 30 day means matched up nicely, but as you went down through water column the variability declined. It wasn't a good match for giving water column information, but good at surface layer.
- Jeremy Testa: I started thinking about the Choptank because there is some hypoxia that develops there but it's poorly characterized and it's been changing due to management actions around the Cambridge Wastewater Treatment Plant. It would be logistically easy for the Oxford crew to get there. The open water criteria there are not as good as other places such as the lower Choptank. I don't know if it's deep enough though. My colleague Dong Liang did an analysis where he used numerical models that we were running, and assumed those models were reasonable representations of reality, and therefore you'd have data in all times and places. Then you'd throw sampling sites out there and figure out what location will allow us to remove uncertainty in the criteria attainment in that place. One of the two places we did that was the Choptank. Criteria evaluation capacity went up a lot in the lower Choptank if you add a deeper channel station there. However that may not be unique to the Choptank.
- Peter Tango: Tom Fishers over the time has shown the cholorophyll increase and DO decrease. Over recent publications that trend was continuing. Change is occurring there. I haven't seen measurable downstream results from the wastewater treatment plant changes. It's also in the MTM list.
- Bruce Vogt: It's ranking high in the MTM list. It's important for living resources as well. There's 3 tributaries that have been restored in that system. There is a large scale oyster restoration. We're interested in that being sustained so we'd like to know about threats and improvements. It's a striped bass spawning tributary and striped bass are on the decline; habitat and environmental drivers have been brought up as influences on recruitment.
- Jim Uphoff: Margaret looked at the routine monitoring data from the Choptank. There's a station between Secretary and Cambridge, and one towards the mouth, and the fresh tidal one at the Gaines. For a heavily agricultural watershed it doesn't show that much sign of DO stress. We've worked a fair bit in Broad Creek, Harris Creek and Tredovan; generally the conditions are good. Tredovan has an issue around yeast. If your interest is in DO than the striped bass spawning grounds are probably not of interest to you. Generally don't see DO less than 5 mg/l in the spawning grounds. We've seen positive

changes in terms of increased pH and alkalinity from 1980s to present. If the emphasis for this array is hypoxia – it's a popular fishing area. The big thing to me is if you were predicting from the nutrient inputs, you'd think the place is a disaster but it's not. There could be something of interest there. Perhaps a lot of processing in tidal marshes. From the standpoint of what you want to look at and the practical kind of management reality, I think the delisting questions will be the most relevant. The fish habitat stuff gets sticky in terms of what the problems are. Are high frequency DO measurements that relevant? That kind of stuff is always of some interest. As far as fish habitat, it depends on what you want to do. If you're trying to relate it all to DO that's a whole different set of issues than striped bass year class has gone low. The data I have indicates the water in the spring is warming up much earlier. In general, in MD where I've looked, the flows have been more frequently below average. Those aren't really DO questions. But there are habitat improvements. Things like pH and alkalinity have gone up and improved. If you start talking metals toxicity, the conditions in the '80s are less likely to occur now. From the fisheries standpoint I'm interested in a broader array of habitat issues than DO. We do look at DO since it's a strong system response in the summer, and it's something we can measure and pull trends out with land use which is our interest. A critical question for us is we need before data in Marshy Hope whether the sturgeon spawning area is and above there because of the recirculating AquaCon, the big salmon plant they're proposing for Federalsburg. There might be a DO question there but it may not be the driving interest. We'd love to have some good before data.

- Mark Trice: From the larger Bay assessment standpoint it would be useful to have one lateral network of these, one on the east, one on the west, to look at these issues of when we have low DO swap from one side to the other. That would help with modeling in general and criteria assessment for whatever assessment you did it in. You can look at the movement of dead zones.
- Jim Uphoff: I asked some of our fisheries folks if they had anything of interest and they said the middle to lower Potomac would be of interest because they get repeated reports of crab jubilees in there. You have to link that to shallow water monitoring to understand what's going on. We saw in St. Clements Bay there was a signal of poor DO with extended periods of southwest winds. Maybe that's a plus for lower Potomac; I can't tell you exactly where but Tom may have a better idea.
- Mary Fabrizio: I think the idea to focus on lower Potomac and lower Rappahannock makes a lot of sense, especially from a fisheries perspective. In VA we see DO occur in Rappahannock some years but not other years. Anything that will improve the accuracy of the DO model that the folks on the call are developing will help fisheries.
- Bruce Vogt: When you're saying that will help fisheries, having that better accuracy, or linking improved DO model to what you're seeing from the surveys? You've done habitat suitability modeling with Aaron, looking at striped bass habitat, forage, connection to DO.

- Mary Fabrizio: Yes, improving the accuracy of the models is what will help us ask questions in fisheries. The limitations come from the issues that the modelers were talking about. Regarding questions on the post-release mortality of striped bass, that is outside the scope of these sensors, that requires a different approach. If we can improve the accuracy of the existing models (even more so) then your choice of station should be driven by that.
- Marjy Friedrich: Getting more information in lower Potomac and lower Rappahannock will help the modeling efforts. A July cruse found the hypoxia mysteriously went away from the lower Potomac despite being in mainstem and mid-Potomac.
- Cindy Johnson: From VA DEQ's perspective, we'd like to see CB5 and the Rappahannock. CB5 has all designated uses, and the Rappahannock empties into CB5 and is deep. We have a station near the deep channel in the Rappahannock, but not in the deep channel. That would produce good data for us where we don't have great data yet.

Jeremy Testa commented in the chat:
Localized Water Quality Improvement in the Choptank Estuary, a Tributary of Chesapeake Bay.
Summer bottom DO near Cambridge has been below 3, recently closer to 4.
Bruce Vogt commented in the chat:
How about striped bass mortality from catch and release (DO and temperature stress)?
Jeremy Testa commented in the chat:
Marjy, was the low/no Potomac hypoxia in the model or also data too? (This questioned was not answered but from Marjy's comments, it sounded like it was from the data.)

2:45 - Next Steps

- The spreadsheet will remain open for comment over the next week.
- The leadership team will use input to recommend 5 sites for a 2023 deployment (a final decision will be made by NOAA and EPA sometime in October)
- The Collaborative will continue to meet throughout 2023 to identify additional station locations and discuss data and analysis products.

✓ Add your input on site locations to the spreadsheet. If you have specific locations in mind for the Potomac and the Rappahannock, provide that as specifically as you can to the latitude/longitude level. Feel free to add places not mentioned today that you think would have value – we don't need to limit it to what was discussed today.

✓ Next meeting:
  - What do chosen locations mean for logistics?
  - We had mentioned having a reference location and we didn't get to talk about this yet – in the future consider this for longer term planning.

3:00 - Adjourn

Supplemental Data/Information

DO data collected from two pilot locations (May-September, 2022) can be accessed here:

- *East Gooses Reef*
- *West Gooses Reef*